JOB NO.: IGS04-19 W.O. #99-76607-0

TITLE: COMPRESSOR CONTROLS UPGRADE

DESCRIPTION: Convert air compressor controls from Fairchild pneumatic calculating relays to Modicon PLC or Elliot Digital controller EDC-16's with Air Manager.

JUSTIFICATION: ECONOMIC

RATE OF RETURN:	35 %
PAYBACK PERIOD:	3.2 years
BENEFIT/COST RATIO:	4.72
ECONOMIC LIFE:	20 years
PV SAVINGS:	$602,409
SALVAGE VALUE:	$0

ADDITIONAL DETAIL: The Fairchild pneumatic calculating relays are outdated and give poor control. They require frequent adjustments. Putting them on a digital controller would allow us to tightly control the inlet butterfly valve saving at least 5 percent on auxiliary power usage by lowering the set point from 118 to 112 psi and even more when running at 2.5 compressors worth. If we use the Elliott Digital Controller EDC-16 control panel, we could link them together with the Air Manager to allow automatic starting and stopping of the standby compressor. The air manager would leave two compressors at full amps and throttle back on the 3rd to partial load. If the load goes down more, it opens the unloading valve. When that has been open for 30 minutes, it will shut the compressor down. The EDC-16's costs about $22K each. It is proposed to install the controls on two units the first year, plus air managers, and then do the other two the next year. An outage is not required, as we could install them on the offline standby compressor. It has been recommended by Elliott to connect the inlet air outside the building using a duct. This would allow for compressing of cooler, less humid air and further increase efficiency.

COST ESTIMATE:

	2004-05	2005-2006	Total
Engineering Labor	$10,000	$5,000	$15,000
IPSC Labor	$30,000	$20,000	$50,000
Contractor	$0	$0	$0
Material	$50,000	$47,000	$97,000
Job Total	$90,000	$72,000	$162,000

ALTERNATIVES: Deferral or avoid. Recommend to install EDC-16's on two compressors the first year, along with air manager, then complete the final two compressors the second year.

EFFECT OF DEFERRAL: Continued inefficiency of air compressing due to poor inlet valve control and venting 30 percent of over compressed air.

PROJECT HISTORY: None

JOB NO: IGS04-8 W.O. #04-16783-0

TITLE: Unit Oxygen Probe Replacement System

DESCRIPTION: This project replaces the present COSA oxygen probe system on the boiler with a multiple position 16 probe system on the boiler economizer outlet area.

JUSTIFICATION: ECONOMIC

PAYBACK PERIOD:	2.9 years
BENEFIT/COST RATIO:	2.34
ECONOMIC LIFE:	10 years
PV SAVINGS:	$339,842
SALVAGE VALUE:	$0
RATE OF RETURN:	36%

ADDITIONAL DETAIL: The present oxygen indication system has become unreliable over the last two years. The maintenance requirements have continued to escalate on this system as the probe failures have continued to increase. This has caused the unit operator to run the unit without accurate O2 indication. In these situations we can run with too much airflow causing us to be inefficient, which has been the case most of the time, or low airflow which can cause a combustion problem with the boiler. The new design will have eight probes on the east side and eight probes on the west side at varying depths to provide a more accurate averaged signal from each side. We will then be able to receive an accurate indication of the stratification that is present in the economizer outlet and provide an accurate averaged signal to the operators.

COST ESTIMATE

	2004-2005	2005-2006	Totals
Engineering Labor	$5,000	$5,000	$10,000
IPSC Labor	$5,000	$4,000	$9,000
Contractor	$73,000	$58,000	$131,000
Material	$265,000	$187,000	$452,000
Job Total	$348,000	$254,000	$602,000

ALTERNATIVES: Continue to use existing inaccurate indicators.

EFFECT OF DEFERRAL: Maintenance and replacement costs continue to increase. Parts are difficult to obtain in a timely manner. During 2004, parts on the last two orders have taken 142 days and 43 days to receive.

PROJECT HISTORY: None.

JOB NO: IGS05-06 W.O. #05-54059-00

TITLE: BFPT Controls Upgrade

DESCRIPTION: Install redundant, electronic speed and operational protection controls on all boiler feed pump turbines.

JUSTIFICATION: ECONOMIC

RATE OF RETURN:	28%
PAYBACK PERIOD:	0.5 year
BENEFIT/COST RATIO:	3.63
ECONOMIC LIFE:	20 years
PV SAVINGS:	2,250,087
SALVAGE VALUE:	$0

ADDITIONAL DETAIL: In an effort to improve reliability and avoid significant operating costs associated with derate and forced outage of the boiler feed pump turbine (BFPT), it is recommended to upgrade the existing 20 year old GE-MDT20 analog controls with digital controls and a state-of-the-art governor system. The general replacement scopes are:

Priority	Existing Subsystem	Replace With
1	Governor Oil System	Digital Field Configurable Controller
1	Speedtronics Mark II	Digital Field Configurable Controller
1	Mechanical Over-speed	Digital Triple Modular Redundant Over-speed Trip System
1	Low Pressure Hydraulics	High Pressure Hydraulics System

The new system features are fail-safe, reliable, online testable, and replaceable. Additional benefits are:

Improving Operation Reliability

In 2004, the existing BFPT control and over-speed trip solenoids have caused two forced outages and three forced derates, or a total generating capacity loss of 4,511 MWhr. The current antiquated controls are very difficult to troubleshoot. It is very tedious as the analog circuits interrelate to each other causing a cascading effect of malfunctions. Sometimes the cause of the shutdown comes back to create recurring operating problems.

Avoiding Controls Obsolescence

The BFPT controls (GE MDT20) are analog controls that are over 20 years old. Unlike digital systems, analog control systems tend to degrade with time and require more frequent adjustments. These systems are now considered obsolete by the OEM and are only supported by third parties that cannibalize components from old cards since the card components are no longer manufactured. The end product is relatively unreliable. In the future, it is expected the old card inventory to be depleted, resulting in a significant predicament with an emergency to replace these controls.

Improving Equipment Longevity

Failures of the BFPT components (seals, labyrinths, blades, rotor, etc.) are typically resultant of the actual over-speed conditions and lube oil failure. According to the OEM, the new system will feature a significantly more reliable (99.999% reliability) electronic over-speed trip device and redundant lube oil pressure supervisory system. Additionally, both of these systems are on-line testable without having the need to trip the turbine.

Currently, the OEM requires the existing over-speed "governor" to be tested prior to any start-up. This process requires the machine to run up to 10 percent over-speed to be able to calibrate and/or verify the over-speed trip set point. This practice is a time consuming and creates additional stress on the components and auxiliaries. The new digital over-speed trip device is reliable , consistent and is not subjected to mechanical wear. It allows online testing without the machine actual over-speed.

COST ESTIMATE:

	2005-2006	2006-2007	2007-2008
Engineering Labor	$40,000	$10,000	$10,000
IPSC Labor	$0	$0	$0
Contractor	$0	$750,000	$670,000
Material	$0	$0	$0
Job Total	$40,000	$760,000	$680,000

ALTERNATIVES: Continue to operate with the lower BFPT control reliability and perform actual over-speed test every outage.

EFFECT OF DEFERRAL: Reduced reliability of the BFPT and continue to be subjected to forced outages and forced derates.

PROJECT HISTORY: In 2004 alone, the existing BFPT control and over-speed trip solenoids have caused two forced outages and three forced derates, or a total generating capacity lost of 4,511 MWhr.